the planning and management process. Problems, conceptual models, goals, objectives, quantified targets, and the restoration actions that flow from them must be re-evaluated and, if needed, revised to reflect the most current information. Such re-evaluation and revision is essential to ensure that the restoration program is achieving its objectives efficiently and to prevent wasting resources upon restoration actions that do not contribute toward achieving objectives.

To better define restoration objectives, the ERP should specify quantitative restoration targets, as best as possible. The ERP has yet to complete this important task. A process for setting, evaluating, and revising restoration targets needs to be developed. This process should be science-based, using the best available scientific information and judgement through the CALFED Science Program and the independent scientific review process.

PROPOSED ERP TARGET SETTING, EVALUATION, AND REVISION PROCESS

The process proposed here would be used to evaluate and refine existing targets, set targets for program objectives and elements without quantitative targets, and future target evaluation and refinement through the adaptive management process.

STEP 1: Initial evaluation of existing ERP targets for strategic objectives and ecosystem elements.

- Step 1A: Proposed ERP Science Board, or an equivalent independent scientific review panel, evaluates existing quantified targets in the ERPP and classifies them into three categories: (1) stated target has sufficient scientific basis and stated justification or rationale is sufficient; (2) stated target has sufficient scientific basis but stated justification insufficient; (3) stated targets needing revision (i.e., insufficient scientific basis). Steps 1A and 1B conducted concurrently.

- Step 1B: Staff (CALFED or combined CALFED/agency/stakeholder staff) identify strategic objectives and ecosystem elements without quantified targets. Steps 1A and 1B conducted concurrently.

- Step 1C: Science Board develops priority list of strategic objectives and ecosystem elements for target setting (i.e., those without targets), target revision, and additional target justification (based on information from Steps 1A and 1B). Identifying objectives and elements for which there is currently insufficient scientific information to establish targets, and the required information needs (and perhaps actions to provide needed information), would be included in this step.

STEP 2: Provide additional scientific justification for targets with sufficient scientific basis.

For targets determined by the Science Board to be scientifically sound (i.e., sufficient scientific basis) but lacking sufficient justification, staff (CALFED or combined CALFED/agency/ stakeholder staff) and/or consultants would write scientific justification. Step 2 would be performed concurrent with Step 3.

STEP 3: Establish and revise targets by topic area.

For objectives and elements without existing quantitative targets or with existing targets needing revision, small technical teams would establish or revise targets and provide justifications for sets of objectives and elements by topic area (e.g., fish species, fluvial geomorphic processes, Delta wetland and aquatic habitats). Technical team composition: A team for each topic area or category composed of three to five environmental scientists and managers with expertise in the that topic. The Science Board, in consultation with ERP, agency, and stakeholder staff, would establish topic areas and select team members. The Science Board would provide scientific guidance and oversight for the teams. Staff would provide team administrative support and day-to-day management. For each objective/ element topic area, the product

of this step would be proposed targets based on best current scientific information (i.e., report presenting proposed targets and scientific justification). For targets that can not be determined because sufficient scientific information is currently lacking, identify scientific information needs and related actions (research, modeling, monitoring). Step 3 would be performed concurrent with Step 2.

STEP 4: Scientific review of proposed targets.

Step 3 products (proposed targets and scientific justifications) would be reviewed by the Science Board and made available for review and comment by agency and stakeholder environmental scientists and managers. These reviews could be sequential with revisions after the Science Board and before broader review, or concurrent with revisions after all comments.

STEP 5: Policy level review and establishment of targets.

- Step 5A: Ecosystem Roundtable review, comment, and recommendations on proposed scientifically based targets. Recommendations should include policy justification.

- Step 5B: CALFED Management Team and Policy Group (or future CALFED/ERP governing entity) consideration of proposed scientifically based targets and Ecosystem Roundtable recommendations. Final policy review, revision, and establishment of targets.

DECISION NODES

Adaptive management includes several crucial decision nodes (Figure 3-1) that have the potential to be bottlenecks. Decisions about which projects to implement and which to postpone, when to gather more information and when to proceed with large-scale restoration, when to terminate projects and when to change direction, and when to declare the success or failure of a particular intervention are difficult and contentious. Although rigorous data analysis and modeling can help with these decisions, they cannot determine the decisions. Efficient progress in adaptive ecological restoration will depend on having institutional arrangements that facilitate effective communication and decision making. A significant element of subjectivity in decisions about whether to proceed will always exist. Open discussion may help to resolve many contentious issues and decisions; nevertheless, in such a large, complex public program there will always be a need for a formal dispute resolution process.

The bottleneck in decision nodes is also important for regulatory compliance. Many of the decision points in the adaptive management system will require state and federal agency approvals for actions recommended by the adaptive management process. Early identification of the decision points requiring public agency approvals can reduce the potential for delays resulting from a disconnect between the adaptive management process and applicable regulatory requirements. Adaptive management decisions made within a regulatory context also will be less vulnerable to challenges.

♦ CHAPTER 4. GOALS AND OBJECTIVES

DEVELOPMENT OF CALFED PROGRAM MISSION AND OBJECTIVES

In the scoping phase of the CALFED Program in 1996, stakeholders and agency staff developed a mission statement, objectives for four problem areas (ecosystem quality, water quality, water supply reliability and levee system integrity) and solution principles to guide the development and implementation of the Program (Figure 4-1). A series of sub-objectives were developed for CALFED's ecosystem quality objective. These sub-objectives guided the development of implementation objectives that were incorporated into the 1997 version of the ERPP. As the ERP became more specific in its approach and proposed actions, it became apparent that the CALFED objective for ecosystem quality and the implementation objectives did not provide enough specificity or direction.

In 1998, CALFED Program and agency staff, the BDAC Ecosystem Restoration Work Group and the Core Team developed the six goals which were presented in the June 1999 version of the Strategic Plan for Ecosystem Restoration. The six goals were reviewed by the Ecosystem Restoration Program Focus Group and minor revisions made in June 2000. The goals are considered final and are not intended to change. For each goal, the Core Team also developed a draft set of objectives. In revising the goals, the ERP Focus Group also revised the objectives to be consistent with the Multi-Species Conservation Strategy. The ERP Focus Group also added rationales that clarified the objectives. Some of the rationales had been prepared originally by the Core Team, but some were created by the Focus Group.

CALFED ECOSYSTEM RESTORATION GOALS

This document is a guide for achieving a reasonable level of *ecosystem quality* for the Bay-Delta system in a way that reduces conflicts among beneficial uses of California's water. The key term "ecosystem quality" is not well defined but it presumed to equate to "ecosystem health" and "ecosystem integrity" (e.g., Woodley et al. 1993). All of these terms imply the desirability of ecosystems that not only will maintain themselves through natural processes with the minimal human interference possible but also will be aesthetically attractive and produce goods and services in abundance for humans.

The ERP goal statements below provide the basis for a vision of a desired future condition of the Bay-Delta system. Basically, they lead to a definition of what is meant by "ecosystem quality" as applied to the Bay-Delta system. CALFED's goals for ecosystem restoration (referred to in the ERPP as "Strategic Goals"), developed by a diverse group of representatives from CALFED agencies, academia and the stakeholder community, are as follows:

1. Achieve recovery of at-risk native species dependent on the Delta and Suisun Bay as the first step toward establishing large, self-sustaining populations of these species; support similar recovery of at-risk native species in the Bay-Delta estuary and the watershed above the estuary; and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed.

2. Rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing

RELATIONSHIP OF CALFED MISSION, OBJECTIVES AND SOLUTION PRINCIPLES TO ERP GOALS AND OBJECTIVES

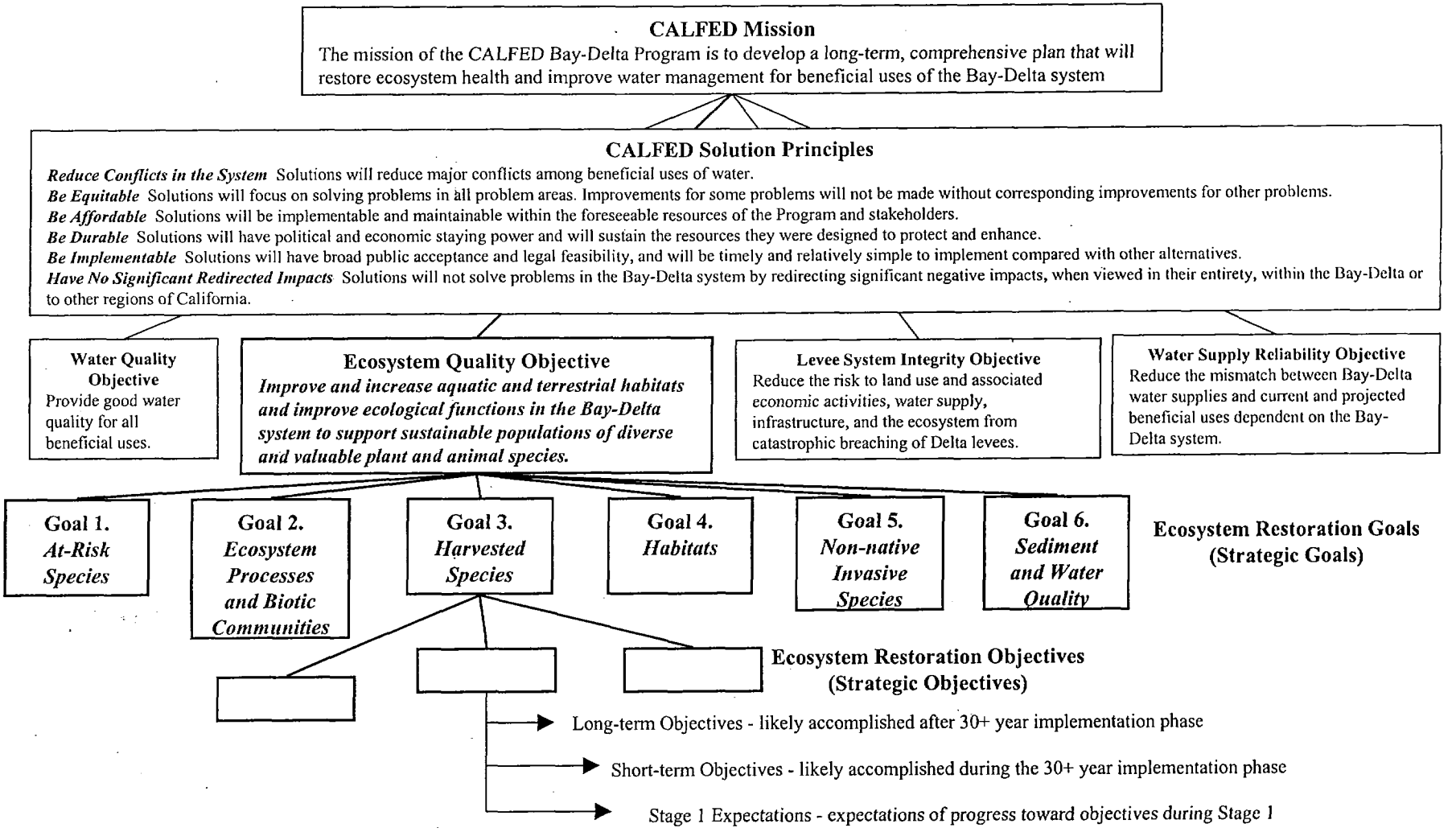


Figure 4-1: Relationship of CALFED Mission, Objectives and Solution Principles to ERP Goals and Objectives

human intervention, natural aquatic and associated terrestrial biotic communities and habitats, in ways that favor native members of those communities.

3 Maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP strategic goals.

4 Protect and/or restore functional habitat types in the Bay-Delta estuary and its watershed for ecological and public values such as supporting species and biotic communities, ecological processes, recreation, scientific research, and aesthetics.

5 Prevent the establishment of additional non-native invasive species and reduce the negative ecological and economic impacts of established non-native species in the Bay-Delta estuary and its watershed.

6 Improve and/or maintain water and sediment quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed; and eliminate, to the extent possible, toxic impacts to aquatic organisms, wildlife, and people.

WHAT ARE THE GOALS DESIGNED TO ACHIEVE?

First, the goals reflect a desire for ecosystems that are not continually being disrupted by unpredictable events, such as the invasion of non-native species capable of altering ecosystem processes, massive levee failures, or the collapse of populations of native species. The ecosystems should be dynamic but function within known limits, be resilient in the face of severe natural conditions, and be capable of changing in a more or less predictable fashion in response to global climate change.

Second, the goals reflect the desire for ecosystems that incorporate humans as integral parts of them, as managers, participants, and beneficiaries. According to this description, the ecosystems under the purview of CALFED are not "natural" ecosystems in which humans are primarily observers. Instead, they are systems that continue to be altered by human activity, but in a less harmful way; they include people who live and make a living in them; and they produce products that benefit the larger society, such as water, power, and food.

Third, the goals reflect a desire for ecosystems that maintain substantial self-sustaining populations of the remaining native species and some high-value non-native species (e.g., striped bass, crayfish), with large numbers of species with high cultural, symbolic, or economic value (e.g., salmon, raptors, tules).

Fourth, the goals reflect a desire for a landscape that is aesthetically pleasing and that contains large-scale reminders of the original "primeval" ecosystem, such as salt marshes, tidal sloughs, and expanses of clean, open water.

Fifth, the goals recognize that the ecosystems that will result from CALFED actions will be unlike any ecosystems that have previously existed. They will be made up of mixtures of native and non-native species that will interact in an environment in which many of the basic processes have been permanently altered by human activity and will continue to be regulated by humans. At the same time, the templates for the new ecosystems are the tattered remnants of the original systems and the natural processes that made these systems work.

GOAL 1: AT-RISK SPECIES

Achieve recovery of at-risk native species dependent on the Delta and Suisun Bay as the first step toward establishing large, self-sustaining populations of these species; support similar recovery of at-risk native species in the Bay-Delta estuary and its watershed; and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed.

The conflict between protecting endangered species and providing reliable supplies of water for urban and agricultural uses was a major factor leading to the formation of CALFED. "At-risk species" are those native species that are either formally listed as threatened or endangered under state and federal laws or have been proposed for listing. The goal places highest priority on restoring populations of at-risk species that most strongly affect the operation of the State Water Project and Central Valley Project diversions in the south Delta, such as Delta smelt, all runs of chinook salmon, steelhead trout, and Sacramento splittail. The goal gives highest priority to the legal recovery of species formally listed under the federal and California Endangered Species Acts (ESAs) because of the high degree of legal protection given the species, especially under federal law.

The ERP also supports actions that will lead to the restoration of large, self-sustaining populations of these endangered species and encourages and supports restoration of populations of species whose listing has less direct impacts on water diversions from the estuary, such as salt marsh harvest mouse (marshes in San Francisco Bay) and yellow-billed cuckoo (riparian areas along the Sacramento River). Because many other native species, especially aquatic species, are also in long-term decline, the ERP overall seeks to create conditions in the estuary and watershed that increase the distribution and abundance of native species or at least stabilize populations so that trends toward endangerment and extinction are halted.

Although the overall goal of the ERP is ecosystem rehabilitation, it is highly appropriate that native species be a major focus of the rehabilitation efforts for the following reasons:

- The federal and State ESAs mandate recovery of species, but because there are often multiple at-risk species in a region, ecosystem recovery is usually necessary for achieving recovery of all the species.

- The habitats that make up the ecosystem contain mixtures of native and non-native species, and often the non-native species are part of the reason for declines of the native species (see goal 5).

- Although ecosystem recovery can be difficult to assess, the abundance and distribution of multiple sensitive native species are easier to determine and can indicate whether or not ecosystem processes have recovered.

GOAL 2: ECOSYSTEM PROCESSES AND BIOTIC COMMUNITIES

Rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitats, in ways that favor native members of those communities.

This goal recognizes that an ecosystem restoration plan must include restoration and maintenance of ecosystem processes, such as seasonal fluctuations in flow of streams and salinity of the estuary, cycling of nutrients and predator-prey dynamics, to support natural aquatic and associated terrestrial biotic communities. Biotic communities are dynamic assemblages of interacting species that occupy a common environment and share similar physiological tolerances. Ecosystem processes in natural biotic communities vary within predictable bounds. Excessive variation beyond these bounds is a symptom of poor ecosystem "health," often caused by disruptions such as introduction of exotic species or shifts in flow patterns. Particular assemblages of organisms within defined sets of conditions (the biotic communities) therefore become indicators that the ecosystem is functioning in ways regarded as desirable. For example, if the system is managed to sustain high-flow events in March and April, conditions may favor a suite of native fishes (e.g., splittail, hitch, chinook salmon) that respond positively to the increase in shallow-water habitat by flooding. Two key aspects of this goal are (1) to have self-sustaining biotic communities that will persist without continual high levels of human manipulation of ecosystem processes and species abundances and (2) to have communities in which the dominant species, as much as possible, are native species.

This goal emphasizes rehabilitation rather than restoration because so many of the physical and chemical processes in the watershed have been

fundamentally altered by human activity. Dams, diversions, levees, and changing patterns of land use have altered the way water, sediments, nutrients, and energy cycle through the system. These changes, largely irreversible within human time scales, set constraints on the nature of the biotic communities that can be maintained. They will allow rehabilitation of ecosystem functioning in ways we find desirable but not restoration of the communities to some pristine state.

GOAL 3: HARVESTED SPECIES

Maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP strategic goals.

This goal recognizes that maintaining some species in numbers large enough to sustain harvest by humans is important, even if the species are non-native. For native species such as chinook salmon, steelhead, and splittail this means maintaining populations at levels considerably higher than those required to keep them from going extinct. For non-native species such as striped bass, signal crayfish, and channel catfish, this means managing populations at harvestable levels but only as long as such management does not interfere with the restoration of large populations of endangered native fishes or disrupt the structure and function of established, desirable biotic communities.

This goal neither precludes nor encourages hatchery programs to enhance populations of sport and commercial fishes. However, hatchery programs that enhance populations of top predators in the Bay-Delta system are likely to have negative effects on other species. The goal refers to "selected" species because some species that may be harvested (e.g., *Corbicula* clams) are also nuisance species whose populations should be reduced. The species selected for harvest management must be chosen in ways that recognize that the species regarded as harvestable vary considerably among ethnic groups and can change with time. For example, most native cyprinids (e.g., splittail, blackfish, hitch) are held in high regard by many people of Chinese heritage even though they are disdained by many anglers of European heritage.

GOAL 4: HABITATS

Protect and/or restore functional habitat types in the Bay-Delta estuary and its watershed for ecological and public values such as supporting species and biotic communities, ecological processes, recreation, scientific research, and aesthetics.

Habitats are usually defined through some combination of physical features and conspicuous or dominant organisms, usually plants (e.g., salt marsh and riparian forest). Plants are often highly visible natural features and have important roles in the function of the ecosystems of which they are part (e.g., salt marshes can fix large amounts of carbon, which may cycle through the entire system). The ERPP (Volume I) identifies major habitat types in the estuary and watershed, and Moyle and Ellison (1991) identify, at a finer scale, freshwater habitat types. By definition, different habitats support different species or combinations of species and play different roles (usually poorly understood) in the dynamics of the Bay-Delta system. It therefore becomes important to protect and restore large expanses of the major habitat types identified in the ERPP and at least representative "samples" of other habitat types as identified by Moyle and Ellison (1991) and others.

Many direct benefits arise from protecting a wide array of habitats, including the recovery of endangered species and the production of economically important wild species (e.g., fish and ducks). Equally important are the aesthetic values of natural landscapes containing mosaics of habitats. Less appreciated, but also important, are the ecosystem services provided by natural habitats, such as purification of water and air and delivery of nutrients to systems producing fish and other economically important aquatic organisms (Daily 1997).

GOAL 5: NON-NATIVE INVASIVE SPECIES

Prevent the establishment of additional non-native invasive species and reduce the negative ecological and economic impacts of established non-native species in the Bay-Delta estuary and its watershed.

This goal is arguably part of the first four goals because protecting and enhancing species, communities, and habitats in an estuary and its watershed implicitly includes reducing the impact of non-native invasive species. However, the introduction of new species into the system is still occurring so frequently, and the potential for ecological damage by further invasions is so high, that the necessity for halting (not just reducing) further introductions needs to be emphasized. Hobbs and Mooney (1998) document how invasions by non-native species are a major ecological force for change in California. Cohen and Carlton (1998) have labeled the San Francisco estuary as the most invaded estuarine ecosystem in the world and document the accelerating rate at which new species continue to become established, mostly as the result of their deliberate release through the dumping of ballast water of ships. Other sources include illicit introductions by anglers (e.g., northern pike) and aquarists (e.g., *Hydrilla*). This problem needs to be dealt with quickly and directly because new invading species can negate the effects of millions of dollars spent on habitat or ecosystem restoration. Likewise, already established non-native species, such as water hyacinth and the Asian clam (*Potamocorbula*), continue to have major negative impacts on more desirable species in the system, and methods of control have to be devised. However, control methods must be less harmful to native species than the ecological disruption caused by invading species.

CALFED Nonnative Invasive Species Program

The CALFED Nonnative Invasive Species Program is a new program managed by the US Fish and Wildlife Service with the support of numerous agencies, universities and stakeholder groups. The NIS Program is developing a Strategic Plan for managing nonnative invasive species in the Bay-Delta. The NIS Program has adopted CALFED ERP's Goal 5 as its mission statement and has also identified three goals:

Goal I: Prevent new introductions of NIS into the ecosystems of the San Francisco Bay-Delta, the Sacramento/San Joaquin rivers and their watersheds.

Goal II: Limit the spread or, when possible and appropriate, eliminating populations of NIS through management.

Goal III: Reduce the harmful ecological, economic, social and public health impacts resulting from infestation of NIS through appropriate management.

Please refer to Appendices E and F of this volume for additional information on the NIS Program.

GOAL 6: SEDIMENT AND WATER QUALITY

Improve and/or maintain water and sediment quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed; and eliminate, to the extent possible, toxic impacts to aquatic organisms, wildlife, and people.

Similar to the difficulty in solving the problem of introduced species, solving the problems associated with aquatic toxicity could be considered part of the first four goals. However, because toxic effects are pervasive and incompletely understood, developing the needed understanding has been identified as a distinct CALFED goal. This goal is being addressed through the CALFED Water Quality Program in close coordination with the ERP.

Problems associated with toxic substances in the aquatic environment include the following:

- Persistent toxicants such as methyl mercury and PCBs can accumulate and concentrate in the aquatic food web creating health problems for carnivorous fish and for other predator organisms such as raptors and humans. (Most of the organo-chlorine compounds responsible for these effects, such as DDT and PCBs, are

now banned, but residues remain in sediments and tissues of organisms.)

- As older organo-chlorine pesticides and PCBs were banned because of their persistence, ability to concentrate in the food web, and harmful biological effects, they were replaced by non-persistent chemicals, some of which are acutely toxic. Residues of these materials from agricultural applications and residential use can enter watercourses and cause temporary toxicity to resident organisms, including those upon which other organisms must depend for food. Though temporary toxicity might have important effect on the aquatic ecosystem, the effects may be too subtle to be easily observed.

- Naturally occurring toxic substances, such as extracellular algal metabolites, can also cause toxic effects that may complicate the ability to distinguish toxicity due to activities of humans.

- Considerable potential exists for ecological disasters caused by large, sudden influxes of toxic materials, such as might be caused by flood-released toxic mine wastes (e.g., Iron Mountain Mine) or by spills of a pesticide carrier (e.g., the Cantara spill on the upper Sacramento River).

- Some toxic materials can accumulate in sediments where they can negatively affect benthic organisms directly and indirectly, the food webs they support. This is an important mechanism for the continuing entry of DDT and related water-insoluble compounds into aquatic food webs, despite many having been outlawed since the 1970s. Some toxicants, such as some metals, cause relatively little environmental damage when left undisturbed in sediment beds but, when disturbed, can undergo chemical transformation into forms that cause toxicity in the aquatic ecosystem.

- Substances once thought to be harmless or not previously identified in the aquatic environment can have harmful effects in subtle ways, such as the potential for chronic, low-level stress resulting in increased susceptibility to disease or predation and reduced growth rates or fecundity (e.g., carcinogens or hormone disrupters). The impact of toxic substances is also an area in which there is high public awareness. Considerable concern exists regarding the risks of consuming harvested organisms or of drinking water from the system.

CALFED Ecosystem Restoration Objectives

Associated with each of the six goals for the ERP is a series of objectives (referred to in the ERPP as "Strategic Objectives") (See Figure 4-2). The strategic objectives are intended to assess progress toward achieving the associated goal. The objectives are stated primarily in terms of management actions designed to have a favorable impact on the Bay-Delta system. However, some are also stated in terms of studies that will teach us how the ecosystem behaves so that principles of adaptive management can be better employed. For either purpose, the objectives must be tangible and measurable (e.g., a net increase in the abundance of a species or a successfully completed experimental study).

Individual objectives in the Strategic Plan and ERPP are (or will be) linked to conceptual models that indicate how they fit into the bigger picture of ecosystem restoration. Implicit in all the long-term objectives (and many of the short-term objectives) is the idea they will be achieved and may be changed through adaptive management. For example, several long-term objectives are designed to achieve numbers or densities of spawning salmon equivalent to those of some time in the past. However, we will not know if such numerical objectives are realistic until one or more regulated rivers have been manipulated on a fairly large scale. One way that the success of achieving objectives may be determined is through the use of indicators that are fairly easy to measure. According to the CALFED Ecological Indicators Work Group, "Ecological indicators translate program goals and objectives into a series of specific measurements that can be used to determine whether the goal and objectives have been met." Some potential indicators are implied or given in the objectives and Stage 1 expectations, but most will have to be developed.

RELATIONSHIP OF ERP GOALS, OBJECTIVES, TARGETS AND ACTIONS WITH SIMPLIFIED EXAMPLE FOR UPPER SACRAMENTO RIVER FLOODPLAIN AND MEANDER RESTORATION

Strategic Goals (6 presented in the Strategic Plan)

Goals provide the basis for a vision of a desired future condition of the Bay-Delta system

Strategic Objectives (32 presented in ERPP Volume I)

Objectives are specific measures of progress toward meeting the goals. The objectives are based on the best available science, and are not intended to change over time except with new information. Objectives help develop and organize targets and programmatic actions. Objectives are presented for three time frames:

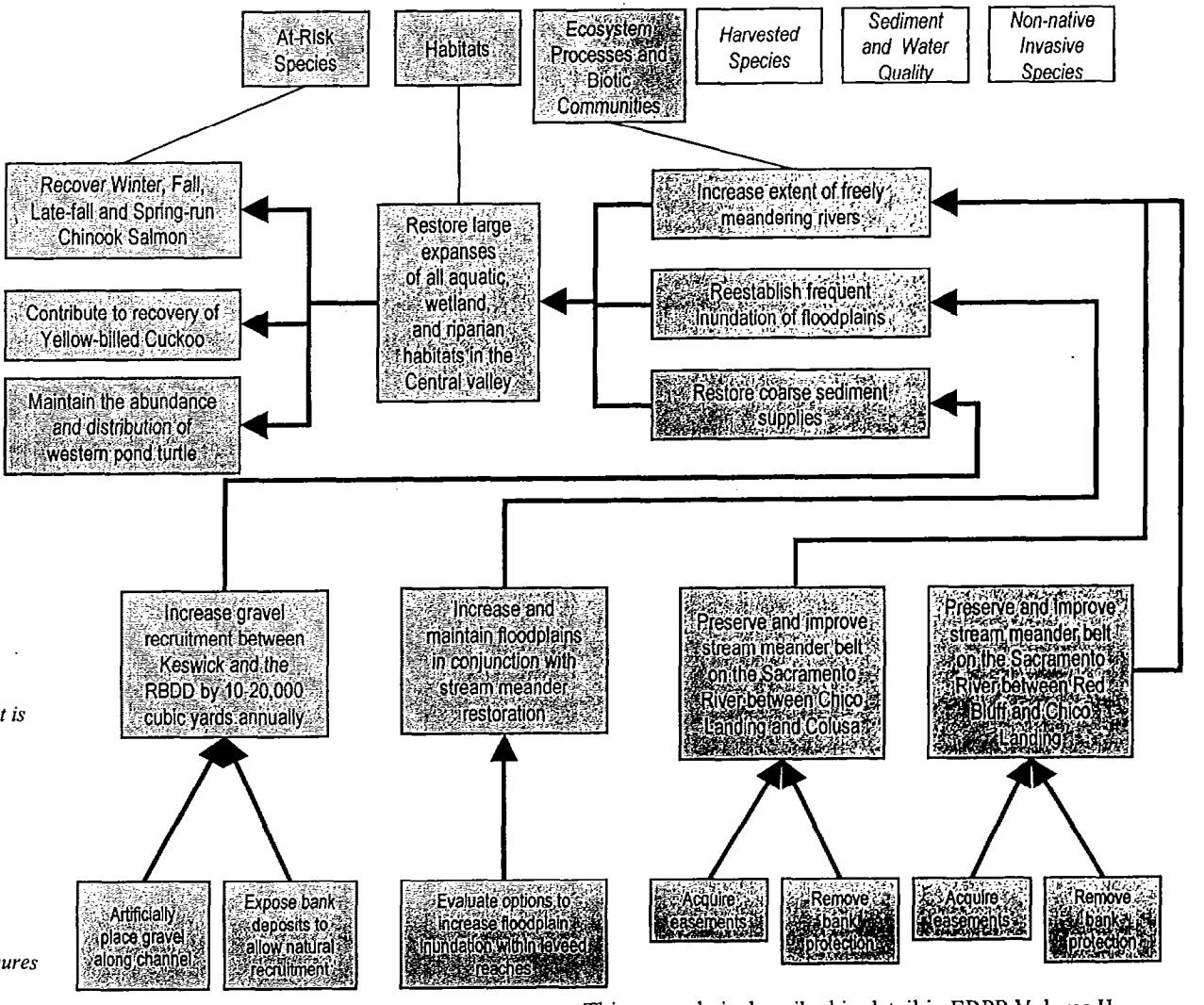
- *Long-term objectives: likely accomplished after 30+ year implementation phase*
- *Short-term objectives: likely accomplished during the 30+ year implementation phase*
- *Stage 1 Expectations: expectations of progress toward objectives during Stage 1*

Targets (over 300 presented in ERPP Volume II)

Targets are quantitative (e.g., a range of numbers) or qualitative (e.g., a narrative description) statements of what is needed in terms of the quality or quantity of desirable ecosystem attributes to meet the objectives. Targets are something to strive for but may change over the life of the program.

Programmatic Actions (over 600 presented in ERPP Volume II)

Programmatic actions are the specific implementation measures required to meet the targets.



This example is described in detail in ERPP Volume II, *Sacramento River Ecological Management Zone Vision.*

Figure 4-2: Relationship of ERP Goals, Objectives, Targets and Actions With Simplified Example for Upper Sacramento River Floodplain and Meander Restoration

The objectives under the six goals often overlap each other broadly or are closely linked. Some may even seem contradictory. Such problems (if they are indeed problems) are inherent in any program designed to make major changes at the ecosystem level. They provide yet another argument for the use of adaptive management as a basic principle to use in implementing restoration programs.

Relationship of Goals, Objectives, Targets and Actions

Ecosystem Restoration Goals and Objectives help develop and organize the numerous components of the ERP. Goals provide the basis for a vision of a desired future condition of the Bay-Delta system. Objectives are specific measures of progress toward meeting the goals. Neither the goals nor objectives are intended to change over time except with significant a change in policy direction or new scientific information. In ERPP Volume II, one or more Targets are identified for each objective. Targets are quantitative (e.g., a range of numbers) or qualitative (e.g., a narrative description) statements of what is needed in terms of the quality or quantity of desirable ecosystem attributes to meet the objectives. Targets are something to strive for but may change over the life of the program. Programmatic actions are the specific implementation measures required to meet the targets. Figure 4-2 graphically depicts the relationship of these components.

ERP Strategic Goals, Objectives, and Rationales

Goal 1: Endangered and Other At-Risk Species, and Native Biotic Communities

Achieve recovery of at-risk native species dependent on the Delta and Suisun Bay as the first step toward establishing large, self-sustaining populations of these species; support similar recover of at-risk native species in San Francisco Bay and the watershed above the estuary; and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed.

Objective 1: Achieve, first, recovery and then large self-sustaining populations of the following at-risk native species dependent on the Delta, Suisun Bay, and Suisun Marsh: Central Valley winter-, spring- and fall/late fall-run chinook salmon ESUs, Central Valley steelhead ESU, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, valley elderberry longhorn beetle, Suisun ornate shrew, Suisun song sparrow, soft bird's-beak, Suisun thistle, Mason's lilaeopsis, San Pablo song sparrow, Lange's metalmark butterfly, Antioch Dunes evening primrose, Contra Costa wallflower, and Suisun marsh aster.

Rationale: This objective addresses species whose populations are likely to further decline if present trends continue and corresponds to the list of species designated "R" (recovery) in the Multi-Species Conservation Strategy. Most of the species designated "R" are either formally listed as threatened or endangered under State and federal laws or have been proposed for listing and their recovery is dependent on improved habitat conditions and restoration of the Delta and Suisun Marsh and Suisun Bay. These are also species for which CALFED could reasonably be expected to undertake all or most of the actions necessary to recover the species. For species with a recovery plan CALFED will implement all necessary recovery actions within the ERP ecological management zones.

This objective places highest priority on restoring at-risk native fish species that are greatly affected by, and in turn strongly affect, the operation of the State Water Project and Central Valley Project. Anadromous and estuarine fish species populations are especially vulnerable to SWP and CVP export diversions in the south Delta. This objective also accentuates the need to recover at-risk native plants and other wildlife species that would likely be affected by CALFED Program actions.

In the early stages of CALFED implementation it is critical to make significant progress towards

improving the population health of the at-risk native species addressed in this strategic objective. Without improved species health it is possible that some CALFED Program actions would not be able to move forward because of the uncertain effects to listed-species populations and the associated regulatory constraints.

This objective also addresses the need for progressive restoration by first working toward recovery of at-risk species dependent on the Delta, Suisun Bay, and Suisun Marsh so that they would no longer need to be listed in order to avoid their extinction. The next step is restoring populations to levels that can be sustained without significant human intervention or the risk of listing in the future. Large self-sustaining populations of species such as chinook salmon would also ensure the concurrent support of healthy commercial and sport fisheries.

OBJECTIVE 2: Contribute to the recovery of the following at-risk native species in the Bay-Delta estuary and its watershed: Sacramento perch, delta green ground beetle, giant garter snake, salt marsh harvest mouse, riparian brush rabbit, San Pablo California vole, San Joaquin Valley woodrat, least Bell's vireo, California clapper rail, California black rail, little willow flycatcher, bank swallow, western yellow-billed cuckoo, greater sandhill crane, Swainson's hawk, California yellow warbler, salt marsh common yellowthroat, Crampton's tuctoria, Northern California black walnut, delta tule pea, delta mudwort, bristly sedge, delta coyote thistle, alkali milkvetch, and Point Reyes bird's-beak.

RATIONALE: This objective corresponds to the list of species designated "r" (contribute to recovery) in the Multi-species Conservation Strategy. For species designated "r", CALFED will make specific contributions toward the recovery of the species for which CALFED actions affect only a limited portion of the species' range and/or CALFED actions have limited effects on the species.

The objective of contributing to a species' recovery implies that CALFED will undertake some of the actions under its control and within its scope that are necessary to recover the species. When a species has a recovery plan, CALFED may implement plan measures that are within the CALFED Problem area, and measures that are outside the Problem Area. For species without a recovery plan, CALFED will need to implement specific conservation measures that will benefit the species.

OBJECTIVE 3: Enhance and/or conserve native biotic communities in the Bay-Delta estuary and its watershed, including the abundance and distribution of the following biotic assemblages and communities: native resident estuarine and freshwater fish assemblages, anadromous lampreys, neotropical migratory birds, wading birds, shore birds, waterfowl, native anuran amphibians, estuarine plankton assemblages, estuarine and freshwater marsh plant communities, riparian plant communities, seasonal wetland plant communities, vernal pool communities, aquatic plant communities, and terrestrial biotic assemblages associated with aquatic and wetland habitats.

RATIONALE: This objective accentuates the importance of conserving all native species assemblages and biotic communities in the Bay-Delta estuary and its watershed. CALFED will undertake actions to conserve and enhance the diversity, abundance and distribution of these biotic assemblages and communities in a manner that contributes to their long-term sustainability, without precluding opportunities to improve conditions for at-risk native species.

OBJECTIVE 4: Maintain the abundance and distribution of the following species: hardhead, western least bittern, California tiger salamander, western spadefoot toad, California red-legged frog, western pond turtle, California freshwater shrimp, recurved larkspur, mad-dog skullcap, rose-mallow, eel-grass pondweed, Colusa grass, Boggs Lake hedge-hyssop, Contra Costa goldfields, Greene's legenere, heartscale, and other species designated "maintain" in the Multi-Species Conservation Strategy.

RATIONALE: This objective includes all of the species designated "m" (maintain) in the Multi-Species Conservation Strategy. These are species that are expected to be minimally affected by CALFED actions. CALFED will ensure that any adverse effects on "m" species are offset commensurate with the level of effect on the